How to reconcile product standardization and diversity of agricultural practices? A challenge for research-action in partnership: the case of farmers' organizations in Costa Rica exporting Marginata Verde and pineapple.

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Abstract:
To continue exporting in competitive markets, small producers need to sell products which fit increasingly strict standards. Nevertheless, the diversity of agricultural practices raises some questions dealing with the coordination between farmers to obtain a product meeting clients' demands. An action-research methodology was designed with two farmers' organizations, one exporting fresh pineapple and the other ornamental plants, to identify socio-technical and organizational innovations with farmers. The diversity of agricultural practices was analyzed and then a debate within farmers' organizations was organized to identify practices which fit the market demands. The conclusions show that different technical sequences at the plot level can be used according to the farmers' objectives and resource availability. The farmers' organizations designed technical specifications to describe these agricultural practices, to train their members, and to negotiate with their clients. In conclusion, the authors emphasize the special role of the technical specifications in the innovation process and the learning process within the research-action stakeholders group.

Key words:
Action research in partnership, farmers' organization, innovation, pineapple, Marginata Verde, Costa Rica

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ASSISTANCE TO FARMERS' ORGANIZATIONS FACING NEW MARKET REQUESTS

Family agriculture in Costa Rica faces the market liberalization process inducing rapid changes in farms' structures (Faure and Samper 2005). Some farmers intensify their farming systems and produce high value added export crops (pineapple, ornamental plants, palm hearts; etc.) with high level risks related to price variations in international markets. Farmers' organizations play an important role linking producers to the outside world (Mercoiret and Berthomé 1995) facilitating access to services (inputs, credit, information, etc.) and organizing product commercialization. Nevertheless, market requests dealing with quality and supply guaranty are increasingly strict. In a competitive context between producer countries there is an obligation to respect a set of standards, sometimes based on strict controls, imposed by governments, importers, or consumers (Henson and Reardon 2005). This evolution doesn't take into account the diversity of the ways to cultivate crops within family agriculture and tends to induce the homogenization of agricultural practices generating exclusion for those farmers who cannot comply with the new standards.

In Costa Rica three stakeholders; a farmers' organization MNC (Mesa Nacional Campesina), the MAG (Ministerio de Agricultura y Ganadería), and CIRAD (Centre de cooperation Internationale en Rrecherche Agronomique pour le Développement) decided to coordinate their efforts to set up a three year program (2003-2005) aimed at strengthening farmers' organizations located in the Huetar Norte region. The program included (i) the design by the farmers' organizations of a shared vision about the family agriculture of the region, (ii) assistance to about ten farmers' organizations to improve their internal management and their results, (iii) the promotion of an innovation process within the farms. In this context, two farmers' organizations participating in this program formulated specific demands to assist members to deal with new standards imposed by the market.

The article presents and analyzes the methodological aspects of the research-action in partnership and discusses the results dealing with the diversity of agricultural practices, respect of standards, and the generated learning process.

In the first case, the pineapple farmers' organization APROPIÑA (Asociación de Productores de Piña) exports a portion of its production to Europe to clients asking farmers for rapid access to the EurepGap certification (Euro-Retailer Produce Working Group- Good Agriculture Practices). The farmers need to comply with a long list of 210 different control points and then are able to obtain certification provided by an independent firm. The most important points are (i) the traceability system implementation, (ii) strict input management linked to specific trainings to limit the contamination of harvested products and the environment, (iii) important infrastructures (input storage, potable water access, etc.), (iv) compliance with national regulations in dealing with labor rights and environmental protection, (v) initial certification costs and annual renewal. These requests generate significant difficulties for farmers in terms of technical changes and production cost increases. These requests are in addition to those based on final product quality (size, sugar rate, etc) and commercialization organization (volume, schedule, etc) which remain valid. The farmers' organizations are taking into account the members' capacity to face this challenge without

compromising their incomes and their capacity to avoid an exclusion process generated by the homogenization of agricultural practices (Faure et al. 2005).

In the second case, an ornamental plant farmers' organization ASOPRO La Tigra (Asociación de Productores de La Tigra) mainly sells Marginata Verde (*Dracaena marginata*) to different foreign countries (Korea, United States, Spain, etc.). Apart from the fact that a regular supply system is needed, the clients asked for adherence to the timetable and the quality which is defined in the contracts (plant size and diameter, clean leaves, etc.). The product quantity needed to comply with the contract is derived from various small farms which have different resources and production conditions. They implement different technical sequences at the plot level. A technical sequence is a set of practices implemented by the farmers to cultivate a crop in a plot given their objectives, resources and constraints. In the cas of Marginata Verde the technical sequences have some key points, which are plant pruning (operation date and intensity) and fertilization (nature and dose). Commercialization is difficult to manage. Either the organization refuses some members' deliveries which do not comply with the standards, generating internal conflicts, or takes the risk of having the delivery rejected by the client at the final destination, generating losses for the organization and for its members. So the farmers want to improve product quality and regularity dealing in with standards compliance, and the internal coordination between members to comply with the contracts.

Table 1 : EurepGap Standards impact (pineapple) and quality request (Marginata Verde) on farmers' agricultural practices and the farmers' organizations.

	APROPIÑA	ASOPRO La Tigra
Questions asked by farmers and organizations	How to respect EurepGap standards by producing cost-effective and market acceptable pineapple?	How to maintain different ways to produce and meet the clients' requests?
Impacts on farms		
Input management	Very important (toxicity, legislation)	Important (fertilization)
Agricultural techniques	Important (schedule)	Very important (prune, schedule)
Soil management	Less important (fertility)	Not relevant
Specialized equipment	Important (storage, etc.)	Not relevant
Traceability	Very important (book keeping)	Less important
Impacts on organisations		
Planification production	Not relevant	Important
Commercialisation	Not relevant	Important
Certification	Very important (shared certification)	Not relevant

In the two cases, the questions are related to socio-technical and organizational tasks where the stakeholders' involvement in the problem design and action is essential. We are dealing with a co-conception of the innovations (Arkrich and al. 1988, Le Masson and al. 2006).

THE CONSTRUCTION OF SOLUTIONS: RESEARCH-ACTION IN PARTNERSHIP METHODOLOGY

In the first case the demand was directly derived from the farmers' organization with the assistance of a technician from the ministry of agriculture, adept at addressing the challenges of the EurepGap certification. In the second case the researchers contacted the farmers' organization to collaborate on a topic of common interest identified during previous interventions including a participatory diagnosis and strategic plan design. In the two cases, the producers needed quick answers to face an urgent problem when adequate solutions didn't exist (Avenier XXXX).

The researchers involved in the process proposed to carry out a research-action in partnership (RAP) including the following principles: (i) an equilibrium between a will to change and a research purpose, (ii) a double objective aimed at resolving a problem and at producing new knowledge, (iii) a collaborative work between researchers and stakeholders producing a double learning process, (iv) an ethical framework elaborated by all the participants (Liu 1992, Albaladejo and Casabianca Eds, 1997). The research-action in partnership (Dulcire 2006) emphasized the stakeholders association to identify the question(s) to address until the implementation of adequate solutions, through their participation in the RAP's governance mechanisms. In the two cases this RAP is characterized by (i) strong mobilization of the farmers' representatives in the steering process, (ii) a research implication partially through students working on their final thesis in agricultural sciences, (iii) and a short intervention time. This intervention of time varies between 3 and 6 months, without taking into account the period needed to clarify the problem and to identify the first methodological principles, a period which is always lengthy with an intervention with farmers' organizations. This period was included in other activities carried out with these organizations.

IN-DEPTH ANALYSIS OF THE PROBLEM AND DESIGN OF THE METHOD WITH THE STAKEHOLDERS

To address the identified problems several meetings took place between the farmers' organizations representatives, the technician from the ministry of agriculture, and the research team. They allowed the participants to progressively transform the problems identified by the farmers into manageable questions (Darré 1996), to facilitate the creation of a shared language between participants, and to facilitate the enrolment of the stakeholders (Akrich et al., 1988).

At the first step questions related to agricultural practices of crop cultivation were discussed. The technicians, including those usually working with the two farmers' organizations, expressed their will to promote "good agricultural practices", those recommended by the research institutions or those derived from the EurepGap requests. For them "good agricultural practices" implied the implementation of a unique technical sequence at the plot level. The farmers expressed differentiated points of view. Farmers with more resources (financial or labor availability) thought that they could comply with the requests if they could have access to special training and to some financial assistance. They accepted the risk of some categories of farmers being turned out of the market. Farmers with fewer resources or with current agricultural practices divergent from the research recommendations expressed their fear about their capacities to make the requested adaptations. Progressively from this point the RAP's objective evolved into the question: "How can we comply with the market

requests conducive to standardization of the final product and/or some agricultural practices and at the same time deal with the diversity of technical sequences implemented by the farmers?" At this point of the paper « market needs » is related to EurepGap requests for pineapple and quality requests for Marginata Verde

The representatives of the farmers' organizations expressed their desire to obtain at the end of the process a manual including technical specifications describing the agricultural practices (technical sequences) to be implemented by the organizations' members to comply with market requests. From the beginning, the participants decided that the technical specifications derived from a collective effort would remain the property of the farmers' organization, thus defining an ethical framework for the relationship between researchers and farmers.

To address this question an approach similar to the one called intervention-research (David 2001) was defined with all the stakeholders and for each situation a specific disposal was designed. 1 We define a disposal as the stakeholders involved in the RAP including their relationships, the resources and the activities used in the process, and the rules based on a common agreement to achieve the objectives. The disposal included an informal RAP steering committee composed of the representatives of the farmers' organization and the representatives of the research team. It included a set of activities: (i) comprehensive surveys of agricultural practices to characterize the diversity of the technical sequences, (ii) on farm-experiments to validate some hypotheses, (iii) meetings with farmers to analyze the surveys' results, to design solutions to answer the question, and to elaborate the technical specifications, (iv) the use of external scientific expertise to validate some farmers' proposals, (v) and workshops to validate the final results and to formulate proposals with the different bodies (board of the organization, members' general assembly).

Table 2 : Main characteristics of the two research-action in partnership experiences.

	APROPIÑA	ASOPRO La Tigra
Number of members	150 / 200	30 / 35
Origin of the initiative	OP / MAG	Research
Duration of the RAP	3 months	6 months
Groups involved in the RAP	Board of the FO for orientation Ad-hoc committee composed of farmers for discussion and validation	Board of the FO + other farmers for orientation and discussion
Identification of farmers involved in the RAP	By the board of the FA depending on the type of farm	By the board of the FO depending on a classification in 3 agro-ecological zones
Farmers agricultural practices and strategy characterization	Survey of about 35 farms (agricultural practices and strategies) chosen by using a typology	Survey about 6 farms (agricultural practices)) On-farm trials of plant growth depending on the zone and the type of technical sequence
Number of workshops to design technical specifications	4	2
External validation of the technical specifications	Pineapple specialist (research, ministry of agriculture) Firm dealing with certification	Marginata Verde specialist (private firm)
Final validation of the technical specifications	FO General Assembly	Board of the FO
Documents written	Technical specifications Final report on surveys and RAP approach	Technical specifications Final report on surveys, on-farm trials and RAP approach

CHARACTERIZATION AND RECOGNITION OF THE DIVERSITY OF AGRICULTURAL PRACTICES

The research method emphasized the need to characterize the farmers' agricultural practices and technical sequences at the plot level and confront these agricultural practices or the effects of these agricultural practices with the market requests. The presentation of the surveys' results by the researchers to the farmers and the discussions about the results was the starting point to validate or improve the data quality, assess the efficiency of the agricultural practices based on the market requests, characterize the agricultural practices or agricultural practice packages which are coherent with the market requests, and then write them into the technical specifications.

Nevertheless the market requests are different based on the products. In the first case they are related to the nature of the product sold and in the second case they are related to the production process. So the debates with farmers were different.

Marginata Verde

Marginata Verde is a perennial crop. It is regularly pruned (leveling prune) to produce stems which are also pruned (ramification prune) to produce "tips". These "tips" are taped at the bottom to generate roots, then cut and sold. Surveys about agricultural practices highlighted some key steps inside the technical sequence which are relevant to product quality.

Table 3. Common key steps for different technical sequences on Marginata Verde (David-Vaudey 2004)

Month	**Key steps**
1	Liming and magnesium provided if necessary Leveling prune (total or spread over time)
2	
3	
4	First providing of NK fertilizer «Thinning out» plants to produce stems with an objective grade Weeding (manual or chemical)
5	Weeding (manual or chemical)
6	
7	Insecticide or fungicide treatment (optional depending on the plant state)
8	Ramification prune, spread over the next month depending on the objective grade
9	"Thinning out" leaves (shade control, shape of the "tips") Second providing of NPK fertilizer and trace elements
10	
11	Tip preparation and hormone spray to stimulate root growth
12	Insecticide or fungicide treatment (optional) Harvest Weeding (manual or chemical)

For each key step, different procedures and different dates are feasible corresponding to the different agricultural practices embedded in the different strategies to implement technical sequences at the plot level. Three key steps are more relevant for quality management: the leveling prune (date and type of prune), the ramification prune (date), and the fertilization (dose). For each of these three key steps different procedures are discussed with farmers in terms of advantages and disadvantages depending on the consequences on the quality management at the farm level or at the farmers' organization level. The next table shows the results in the case of the leveling prune.

Table 4. A comparison of advantages and disadvantages between two types of leveling prune (ASOPRO La Tigra, 2004)

	Pruning spread over time	**Total pruning of the plants**
Advantages	Flexibility to sell products with production spread over the year	Plot homogeneity facilitating the agricultural operations (fertilization adapted to the real plant needs, reduction of the number of intervention in the plot)
	Technical decision adapted to the state of the stems and to the contracts with clients	No competition for light for the stems derived from the same plant
	Better weed control by maintaining a permanent shade	Commercialization planning easier at the farmers' organization level
Disadvantages	Competition for light between stems with different size	Plant stress during the leveling prune
	Difficulty in adapting fertilization to the real needs of the stems and of the tips	Difficulty with weed management during the leveling prune
	Quality heterogeneity at plot level	Cash flow management more difficult because of the production grouping

During debates with farmers the total plant prune appeared as the more appropriate technique for homogeneity management at the farm level and at the farmers' organization level as well. However its implementation could generate difficulties for farmers with cash flow problems or could be less interesting for those providing less fertilizer and/or having a large labor force.

All of the debates with farmers around the surveys' results finally allowed the participants to identify two main types of technical sequences able on the one hand to maintain part of the diversity according to the different farmers' strategies and on the other hand to face the farmers' organization need for a homogeneous production to satisfy their clients.

Box 1 : Main technical sequences to manage Marginata Verde production homogeneity (David-Vaudey, 2004)

Intensive technical sequence:

- Total plant leveling prune on all the plots
- Plot separation based on stem types produced (4-6 inches large, 12-24 inches, 36-48 inches)
- Three fertilizer treatments provided during the production cycle with a foliar fertilization after the ramification prune
- Trace elements providing based on results of foliar analysis
- Global providing of nitrogen fertilizer during the production cycle, around 600 kg/ha

Intermediary technical sequence:

- Conservation of the two types of leveling prune (total and spread over the time)
- Association of different stem types on the same plot
- Two fertilizer treatments provided during the production cycle, the first one two months after liming and the second one during stem growth, more or less three months later
- Global providing of nitrogen during the production cycle around 350 kg/ha

Pineapple

Pineapple is an annual crop cultivated with technical sequences consuming a large amount of inputs. The surveys showed the variability of agricultural practices for each step of the technical sequence and allowed an alignment with EurepGap standards. Discussing the results, the farmers could identify the more relevant or innovative agricultural practices and progressively designed the technical specifications which take into account their agricultural practices and at the same time address the EurepGap standards and the quality criteria linked to an exported product.

Box 2: Examples of good agricultural practices recommended by APROPIÑA for the pre-seeding treatment of the young plants (Veerabadren 2004)

As far as possible it is best to use healthy and resistant young plants. Nevertheless, especially for the Amarilla and Montelirio varieties, we recommend treating them to guarantee strong initial growth.

If the farmer buys the young plants, he should first observe if the vegetable material is healthy without signs of infection (see EurepGap 3-5-2 standard)

Different methods are used by the farmers of APROPIÑA to treat the young plants:

- The majority of farmers immerse four plants together (two in each hand) in a container filled with a product for treatment (at least five seconds) and then drain the plants to save the product and to avoid soil contamination. In this case it is important to use gloves.
- If the farmer lacks financial resources before seeding he can treat the young plants after the seeding.
- The farmer could treat the young plants in the plot (using a Spray-Boom) where they are cultivated and before there are harvested. Simultaneously, he protects the smaller plants which will be harvested later.

The Young plants are treated with

Type of pesticide	**Active ingredient**	**Dose/container**
Insecticide	Diazinon	0.3-0.5l/ container
		0.3-0.5l/ container
Fungicide	Fosetyl-al	0.3-0.5kg/ container
		0.3-0.5kg/ container
		0.3-0.5kg/ container
		0.3-0.5kg/ container

More or less one container (100 l) is needed for 1000 young plants

The young plants are stored no more then two days after treatment to avoid damage. Besides, we recommend not storing the young plants in an area with running water paths. The farmers of APROPIÑA never store the young plants in an area where chemical products are located (see EurepGap 6-4-7 standard)

The treatment of young plants with pesticides before seeding is registered in a book to record and follow the treatments (see EurepGap 3-4-1 standard).

The farmers of APROPIÑA which regularly observe their young plant production plots never cut the young plants' leaves (it can induce disease development) because they always collect young plants with an adequate size and before a too strong growth.

In this case the surveys and the debates also induced the identification of key steps which are relevant for farmers to produce an exportable pineapple (grade, color, and sugar rate): seeding density and fertilization level. Three technical sequence types were identified with different fertilization levels, the farmers chose a technical sequence based on their objectives, their resources, and their constraints.

Table 5: Different technical sequences identified by the farmers to produce an export quality pineapple (Veerabadren 2004)

	Technical sequence 1: Less Intensive	Technical sequence 2: Intermediary	Technical sequence 3: Intensive
Type of farmer	Lack of financial resources Family labor	Family and paid labor	Important financial resources Paid labor
Seeding density (plant/ha)	25/ 30.000	40/ 50.000	60.000
Number of soil fertilizer providing	1 to 2	2 to 3	3 to 4
Frequency of foliar fertilization	Each month	Every 15 days	Every 15 days
Induced flowering	Spread over the time to valorize the family labor	At one time	At one time
Yield (t/ha)	55	75	95

TECHNICAL SPECIFICATIONS: AN INTERMEDIARY OBJECT

The technical specifications are an intermediary object according to the meaning of Vinck (1999) which emerged during the RAP between the period dedicated to problem definition and the one dedicated to the implementation of changes. It allowed the participants to first determine a concrete and realistic objective to achieve by the stakeholders group, strengthening it and stimulating reflection. The design procedures were determined in the first phase by all the participants and they implied the following of different steps. It created a framework for the reflection organizing more debates. Does this agricultural practice discussed by the participants make sense based on the questions we have? Who uses it and why? Can we generalize it and under what conditions? Is it compatible with other agricultural practices set up in others steps of the technical sequence? Do we take into account all the key steps of the technical sequence?

From the farmers' point of view, the technical specifications are a useful tool to think about their agricultural practices and this reflection is a crucial condition for generating an individual and collective learning process. With deeper analyses among the participants, the main strategies progressively appeared (ii) at the farm level in dealing with productive activities and (ii) at the farmers' organization level in clearly explaining its choices. Should the organization facilitate the access to services for members which are more capable to address the market requests? Is the organization able to answer the needs of members' majority? In the process other questions emerge which make sense and offer more elements to the main debate. How to access to credit to buy authorized inputs which are often more expensive? How to join forces to make an indispensable collective investment?

From the technician's point of view, the technical specifications imply a clarification of their position related to some technical choices based on strict standards. For the researcher the progressive writing of the document is an opportunity to maintain distance with the action, to synthesize the surveys' results about agricultural practices and the farmers' visions about these agricultural practices, and to systematically validate the synthesis with the farmers. This progression also facilitates the crossing between the co-constructed knowledge elaborated during the process and the scientific knowledge mobilized through an expertise from people not participating in the RAP (technicians from private firms, specialist of the ministry of agriculture, researchers from universities). The researcher plays the role of translator (Callon and al. 2001) between different worlds (farmer, technician, and researcher) by producing a scientifically validated document, understandable by the technicians and the clients but taking into account the farmers' vision about the agricultural practices compatible with market requests.

Finally the method to design the technical specifications is an acknowledgement of the local knowledge. First it is an acknowledgement by the farmers themselves which are not accustomed to noting that other people valorize their knowledge, or often think their knowledge is less useful than the technician's or scientist's. This knowledge is "actionable", according to Argyris' meaning (1995) as a farmer has said: "this document is our bible gathering every thing we know for growing pineapple in the right way", showing how useful is it for training. Secondly, it is an acknowledgment by the technicians; those who participated in the process and those who didn't but think that a written document gives legitimacy and a statute to the results. Ultimately it is an acknowledgement by the clients who usually thank the organization for its effort to clarify and explain its technical choices and put more transparency in the relationship. This effort eventually can facilitate commercial negotiations.

CONCLUSION

The experiences of the two research-actions in partnership addressed with two farmers' organizations the question of farming systems adaptation to market requests. The approach negotiated with all the stakeholders allowed the transformation of the problem to manageable questions and to associate the farmers in the co-construction of the solutions.

The research-action in partnership generated socio technical innovations based on different well suited technical sequences whose implementation depended on the farmers' objectives, resources, and constraints. These innovations were built from the farmers' knowledge and are an acknowledgement of the diversity of agricultural practices compatible with the market needs aimed at the production standardization or at the respect of a set of ever stricter norms. Taking into account this point the knowledge produced during the research-action in partnership is "actionable knowledge" meaning scientifically valid knowledge and usable in the everyday life (Argyris 1995).

The learning processes generated are relevant. In fact the research-action in partnership doesn't resolve the original problem (implementation of Marginata Verde production planning, EurepGap certification for pineapple farmers) because for operational reasons the planning designed by all the participants determined the cessation of the activities after the identification and validation of agricultural practices compatible with the market requests. Nevertheless the two farmers' organizations could start a collective reflection on new internal

coordination mechanisms to resolve the problem of a homogeneous Marginata Verde production or of the EurepGap farms' certification. This point clearly shows how the technical aspects are embedded in complex organizational problems. There is a need for further investigation of the collective learning process. If the elaboration of the technical specifications generated a crossed learning process, the nature of this learning process and especially the effects on the coordination between stakeholders has not been fully characterized during the research-action in partnership.

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